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Review of What American Children Are Eating

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What American Children Are Eating
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Introduction

The world has changed dramatically over the past 30 years. The child that is walking into school in 1995 is different in a number of important ways than the child who walked into school in 1965. The child of 1995 is more likely to have experienced the divorce of a parent, to live in a single-parent household, and to live in poverty (Carnegie Corporation, 1994).

The health and nutritional profile of U.S. children has also changed. In 1960, the infant mortality rate was 28 deaths per 1,000 live births compared to 9 deaths per 1,000 in 1990. Malnutrition, as measured by low weight for age and stunting, has also decreased (Public Health Service, 1994). Part of these improvements can be credited to improved health care and better nutrition.

As the health profile of the U.S. population improved, public health nutrition shifted its focus from problems of underconsumption and nutrient deficiencies to concerns of overconsumption and imbalances in nutrient intake. An extensive body of scientific evidence emerged indicating that the typical American diet high in total fat, saturated fat, and sodium, and low in complex carbohydrates and fiber, was associated with obesity, heart disease and some forms of cancer.[1]

Based on this newer scientific information, in 1980, the U.S. Department of Agriculture (USDA) and the Department of Health and Human Services (DHHS) issued the first Dietary Guidelines for Americans. The Guidelines were subsequently revised in 1985 and 1990 and in 1995 are again under review. Appendix One outlines the USDA/DHHS Dietary Guidelines for Americans. These guidelines, for individuals aged 2 to adult,

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[1]Good summaries of the research are provided in: Surgeon General's Report on Nutrition and Health, DHHS, 1988, and National Research Council, FNB, 1989.

emphasize the overall modifications in consumption patterns that are needed to reduce the risk of diet-related chronic diseases.

The crucial role of diet and nutrition in promoting optimal health in the Nation's children is clearly reflected in Healthy People 2000: National Health Promotion and Disease Prevention Objectives (Public Health Service, 1991). Of the 21 nutrition objectives, eight include a specific provision for children and adolescents (Table 1).

Nutrition has been made a priority by the Department of Agriculture. A part of this commitment is incorporating the Dietary Guidelines into the nutrition programs administered by USDA. The purpose of this paper is to summarize what is known about the consumption patterns of children in the United States and to use this information to make USDA's policies and programs more responsive to the current nutritional needs of children.

The review is organized around the following relevant questions:

1. What are American children eating?

2. How do the diets of low-income children compare to children from other income groups?

3. Is possible for children to follow the Dietary Guidelines and have adequate energy and nutrients for growth?

4. Are there health benefits for children in following a diet based on the Dietary Guidelines?

5. Is obesity increasing in children?

6. What are the major diet-related problems currently for U.S. children?

7. What are the implications for public policy?

What Are American Children Eating?

Data from nationally representative surveys of the U.S. population indicate that caloric intakes of children 1 to 15 years of age have been static or declining since the early 1970s (Tables 2A and 2B)[2]. For a number of age/gender groups, energy intakes fall below 100% of the Recommended Dietary Allowances (RDA). It is only in the 16- to 19-year old age group that recent data for 1988-1991 indicate that energy intakes have increased (Table 2A).

The data in Tables 2A and 2B are reinforced by information from a serial, cross-sectional study. The Bogalusa Heart Study (Nicklas et al, 1993) was initiated in a biracial community in Louisiana in the early 1970s. Within the same community, energy intakes of 10-year-old children have been stable or declining over a 15-year period (Table 3); because children have been getting heavier, the declines in energy intake are more dramatic when expressed on a kcal per kg body weight basis. Caloric intake in 10-year-olds decreased from 65.5 kcal/kg in 1973 to 60.7 kcal/kg in 1988.

The Marketing Research Corporation of America (Albertson and Tobelman, 1993) has compared caloric intakes for 2- to 10-year- old children from 1977/78 to 1986/88. Over the 10-year period the average energy intake of children remained virtually unchanged - 1,632 calories in 1977/78 versus 1,613 calories in 1986/88.

The 1989 Continuing Survey of Food Intake by Individuals (CSFII) reported that despite the fact that only a small percentage of children were consuming the recommended calories, the children were not under weight.

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[2]Some of the methodological problems with tracking energy and nutrient intakes over time are discussed in Appendix Two.

In addition, although average energy intakes for some children have been declining and for many children are less than recommended levels, the average consumption of other nutrients is in excess of 100% of the Recommended Dietary Allowances (Table 4). This finding of more than adequate levels of consumption is true for a broad range of nutrients (USDA, 1993).

Mean levels of nutrient intake can often mask large swings in actual consumption. Table 4 also presents data on the percentage of the child population meeting the target levels for nutrient consumption. Here again, for most nutrients, in excess of 80% of the children are meeting target levels for nutrient consumption. There are some exceptions.

Iron intake has been increasing over the past 20 years, and average intakes at most age levels meet or exceed the 1989 RDA. However, this is not true for teenage girls. In addition, between 14% and 20% of children under age 5 were consuming less than 50% of the RDA for iron in the 1985 CSFII (USDA, 1986). There is no consistent trend associated with income level with the exception of teenage girls where iron intake increases from 76% of the RDA in the lowest income group to 85% in the highest income group (USDA, 1986).

Calcium is another nutrient where intake is low in certain subgroups. Data from the 1988-1991 portion of NHANES III indicate that calcium intake in 6- to 11-year-olds is declining (CDC, 1994). Similar to patterns of iron intake, the prevalence of low intake does not vary consistently with family income. The low calcium intake in children is corroborated by the USDA, CSFII data for 1989-91 (USDA, 1989-91). However, in face of increasing evidence of declining intakes, a recent National Institutes of Health Consensus Conference on Calcium put forth a recommendation that dietary calcium intake for children be raised. Thus calcium intake is declining at a time when there is growing consensus it needs to increase.

Mean intake for zinc was close to the RDA in the 1985 CSFII (USDA, 1986). However, 14% to 20% of children consumed less than 50% of the RDA, and an additional 30% to 40% consumed between 50% and 69% of the RDA. The significance of these

findings is unclear given little other corroboration that zinc nutriture in the U.S. is inadequate. Additional research is needed to better define zinc requirements and to develop better measures of zinc status.

Food insufficiency as measured by inadequate energy intake or deficiencies in intake of other nutrients is not the dominant nutrition problem in the United States. The public health concern in nutrition has shifted from an exclusive focus on nutrient intakes and deficiencies to an emphasis on other dietary components - fat, saturated fat, sodium and cholesterol. The level of fat and saturated fat in the diets of children has been declining since the early 1980s. However, as the data in Table 4 indicate, most children do not consume a diet that meets the Dietary Guidelines. The overwhelming majority of children in the 1989 Continuing Survey of Food Intake by Individuals exceed the recommendation of no more than 30% of calories from fat. In addition, most of the children are consuming diets with greater than 10% of calories from saturated fat and over half of the children's diets exceed 2,400 mg of sodium (USDA, 1989-91). Data from the 1988-1991 National Health and Nutrition Examination Survey indicate that for all groups ages 3 and above, average sodium intake is above 2,400 milligrams (CDC/NCHS, 1994). The major source of sodium in children's diets comes from processed foods. Therefore, strategies to reduce sodium intake must involve the private sector.

Dietary cholesterol intake has declined steadily across all age groups in part due to a decline in egg consumption over the past two decades. Thus, we see from the data in Table 4 that for most age groups 80% to 85% of children are meeting the Dietary Guidelines for cholesterol.

Only recently has information on dietary fiber intake been available from national surveys. The 1985 CSFII survey indicates that 1- to 5-year-old children are consuming, on average, 10 grams per day. Incomplete information on the fiber content of foods makes it difficult to ascertain how much of the low fiber intake in children is due to the low fiber content of foods versus an insufficient nutrient data base. However, given the low

consumption of fruits and vegetables generally by children, low fiber intakes seem plausible (USDA, 1993).

The nationwide surveys of children's diets paint a clear picture of children's consumption patterns. While caloric intake levels for U.S. children have remained unchanged or in some cases declined, the nutrient density of the diet has improved. Average intakes for most nutrients exceed 100% of the recommended levels. Exceptions to this include iron, calcium and zinc. However, children are doing poorly in meeting the Dietary Guidelines. The average diet of U.S. children exceeds the recommendations for fat, saturated fat and sodium. It does not appear likely that the goals for children's diets for fat and saturated fat set forth in Health Objectives 2000 will be met by the Year 2000.

One needs to understand the dietary patterns of children and foods consumed in order to determine what behaviors need to be changed to meet the Dietary Guidelines. Eating patterns have changed dramatically for children over the past 20 years. Children are eating more frequently and obtaining a greater proportion of their nutrient intake from snacks (Woteki, 1992); in 1977, the average number of eating occasions for children was three; by 1985, over half of the children surveyed ate five or more times during the day. Snacks are accounting for an increasing proportion of energy and nutrient intake in children's diets.

In addition, children are eating an increasing proportion of their meals away from home. This is compounded by the fact that an increasing amount of food consumed at home is not actually prepared at home but rather originates at "take away" vendors. These lifestyle shifts imply that improvement in the diets of children needs to concentrate on the role of restaurants and schools as well as on the home.

The Food Guide Pyramid (USDA/DHHS, 1992) translated nutrient intake into appropriate servings from five major food groups. Children's dietary patterns can be compared to the suggested serving sizes in the Food Guide Pyramid. Children are most likely to have the inappropriate number of servings from the fruit group and vegetable groups. Data

from the 1989-91 CSFII indicate that vegetable consumption in the U.S. population, including children, is declining (USDA, 1989-91). Vegetable intake was more likely to be lower in low-income households.

Data in Tables 5A and 5B examine the major sources of calories and fat in the diets of 10-year-old children (Nicklas et al, 1992). In each of the four fat intake categories, the major sources of calories were the bread/grains and dairy groups except among the group consuming the highest proportion of calories as fat. The major sources of fat were the dairy and meat groups. Vegetables and fruits made a much lower contribution to overall energy intake.

How Do the Diets of Low-Income Children Compare to Diets of Children from Other Income Groups?

As discussed in the previous section, the intake of many nutrients does not rise significantly with increasing household income. We now look at the income/nutrient consumption relationship in more detail. The most conventional way to examine this has been to analyze dietary patterns in relationship to household income. Table 6 presents data on average energy adequacy of children's diets stratified by household income level as well as information on the percentage of fat and saturated fat. The data come from the 1-day food intake in the 1987/1988 Nationwide Food Consumption Survey conducted by USDA (USDA, 1993).

The picture that emerges is similar to what was shown for children in general in the United States. Children's energy intake varies little over the income range presented. For lower- income children, energy intakes are below 100% of the recommended level (similar to American children as a whole) but, the average consumption levels for other nutrients are on average well above 100% of the RDA. However, for some age/gender groups there is a tendency for children from lower-income households to consumer slightly higher levels of fat and saturated fat.

Table 7 presents individual dietary data from the 1989 Continuing Survey of Food Intake by Individuals for children by racial/ethnic group. Here again, patterns are similar to what has already been presented. The average energy intake levels are less than 100% for each of the groups, but for most nutrients, average consumption levels are in excess of 100% of the recommended level. Average levels of fat and saturated fat do not vary dramatically by racial/ethnic group.

Minority groups tend to be disproportionately represented among low income households and thus minority status is sometimes used as a proxy for income. From Table 7 it is worth noting that African-American and Hispanic children tend to have slightly lower levels of energy intake than white, non-Hispanic children. However, the African-American and Hispanic children also have slightly higher levels of fat and somewhat higher saturated fat intake.

Data in Table 7 indicate that children in general, regardless of racial/ethnic status, are not meeting the recommendations of the Dietary Guidelines for fat, saturated fat, or sodium. Children do much better achieving lower levels of cholesterol in the diet.

There has been a movement in the past few years away from using household income as the sole proxy for food security. The data presented in Tables 6 and 7 suggest that the diets of children from lower-income and/or minority households are not dramatically different from those of American children as a whole. Some researchers have suggested that additional, qualitative measures of food insecurity might be more useful than income alone in capturing food insecurity (Radimer et al, 1992).

The 1989-91 Continuing Survey of Food Intake by Individuals included a series of questions on household food insecurity. For example, respondents were asked whether households always had (1) enough of the kinds and amounts of food they wanted to eat; (2) enough food but not always what they wanted to eat; and (3) sometimes or often not enough to eat. Table 8 presents data from a 3- day average food intake for children from the 1989

CSFII broken down by these three food sufficiency/insufficiency categories. The patterns on energy and nutrient intake are similar to what has already been presented in that although energy intakes are low, nutrient levels tend to be above requirement levels on average. However, some trends are worth highlighting.

As one moves from the more food-secure to the less food- secure categories, the mean level of energy intake for children falls. In addition, the average level of fat and saturated fat increases for children from the more food-insecure categories. One explanation for the low calories but higher level of fat is cost. Many higher-fat foods are a less expensive source of calories and households that are income- and food-constrained might rely on these for a larger part of the diet.

The term dysfunctional nutrition was coined by one author to indicate bad or poor nutrition based on excesses and imbalances in the diet (Kimm, 1993). The data presented in Table 8 suggest that dysfunctional nutrition resulting in overconsumption of fat and saturated fat, sodium and cholesterol is more likely to affect food-insecure households.

Is it Possible for Children to Follow the Dietary Guidelines and Still Have Adequate Energy and Nutrients for Growth?

The Dietary Guidelines (USDA/DHHS, 1980, 1985, 1990) are a relatively recent development. The premise behind the Guidelines is that these recommendations would build on the recommended allowances for calories and other nutrients. Recently, however, some concern has been raised as to whether it is possible to have sufficient calories for growth if the total fat calories are limited to 30% (Kleinman, 1993).

Some of the earliest studies on the calorie/fat issue come out of research conducted on vegans - defined as persons who have no animal products in the diet. Some studies suggested that vegan children were shorter than their omnivore counterparts (Dwyer, 1983). However, a closer examination of research done on children consuming a vegetarian diet

reveals that low-caloric intake was usually confounded with a low-fat intake. Therefore, it is impossible to ascertain whether the poorer growth of children was due to a low-calorie diet or whether the low energy intake was caused by the restricted-fat intake.

Two other widely quoted studies should be mentioned. Research by Lifshitz and Moses (1989) has been used to suggest that overzealous restriction of fat in a child's diet limits growth. The research is based on a small sample of 40 children, 8 of whom or 20% of the total sample, exhibited retarded growth. It appears from the data presented that these children were both calorie-restricted as well as fat-restricted. The mean intake was 24.4% of calories as fat for children who were failing to grow compared to 29.6% among the 32 other children who were growing normally. Children with growth failure tended to be older, suggesting that these children may have been consciously self-imposing a diet limited in fat and calories. Also worth noting is there was no control group for comparison in this study.

Similarly, the research of Pugliese et al (1983) indicates that the major reason for inadequate growth was the low energy intake of children; the percent of calories from fat was not reported.

Clearly the earlier studies were not designed to document the effect of calories versus fat on child growth. It is not surprising that a limitation of energy intake would have negative effects on child growth.

Several recent studies have directly addressed the question, "Can a child have adequate calories on a diet limited to 30% of the calories from fat?" Data from the Bogalusa Heart Study (Nicklas et al, 1992), energy intake for 10-year-old children stratified by four levels of fat intake (Table 9). While the caloric intake of the child fell with decreasing levels of dietary fat, all children had energy intakes within the recommended range for 7- to 10-year-old children. The caloric intake of children in the lowest fat intake group was 25% lower than that of children in the highest dietary fat group. However, the average weight for height of

the children did not vary by fat intake group. Thus while fat intakes of children varied, growth patterns appeared similar.

These data appear to suggest that children can consume low- fat diets and have adequate growth patterns. However, the dietary data are based on a 1-day recall; it is not clear that children whose diets are classified in the low- or high-fat group would consistently fall into these same categories if multiple days of dietary observations on the same child were available.

Also worth noting is the commentary of the authors indicating that fat in the diet had been replaced by refined carbohydrates (Nicklas et al, 1992); the Dietary Guidelines suggest that fat be replaced by complex carbohydrates and thus many of the children in the Bogalusa study were not adhering to these guidelines. More attention needs to be given to what replaces fat in the diets of children.

The study of (Shea et al, 1993) was able to collect multiple days of dietary intake on 215 children ages three to four. Four 24-hour recalls in addition to three food frequency questionnaires were available for each child. Table 10 stratifies data by fat quintile levels. Total fat provided 27.1% of total calories in the lowest category and 38.4% in the highest category. There was no significant difference in height or growth across the different categories of fat intake. The authors conclude that the data from this study support the safety of a moderately fat-restricted diet in healthy preschool-aged children. The authors do note that a milk source needs to be included in the child's diet in order for calcium requirements to be met.

A recent study in Canada (Gibson et al, 1993) collected 3-day food record information on 106 omnivorous children with a mean age of 4.9. The sample included children with 30% of calories from fat and 10% of calories from saturated fat, as well as preschoolers consuming diets with greater than 30% and 10% of fat and saturated fat, respectively. No significant differences were found between the two groups in height for age, weight for age or weight for

height. Here again, the authors conclude that a diet with 30% of total calories from fat and 10% of total calories from saturated fat can provide sufficient energy and other nutrients for normal growth. However, similar to the research of Shea et al (1993), this study concludes that a low-fat source of milk must be included in the diet in order to meet calcium requirements.

Taken as a whole, the research related to children's health and diets conforming to the Dietary Guidelines suggests that there is evidence that a diet with 30% and 10% of calories from total fat and saturated fat, respectively, can accommodate adequate growth in children as long as energy intake is adequate. Conversely, there is no evidence that a diet with adequate energy and 30% of the calories from fat has any negative health effects.

Are There Health Benefits for Children in Following a Diet Conforming to the Dietary Guidelines?

All but one of the Dietary Guidelines (that relating to alcohol) relate to children, and there is extensive evidence that a diet based on these Guidelines is healthful. However, a good deal of controversy revolves around the benefit of these Guidelines to reduce fat, saturated fat and cholesterol in the diets of children. This section examines the evidence related to this Guideline.

Results from a number of the studies in the previous section suggest that children can achieve adequate growth on diets with 30% of the calories provided by fat as long as the caloric consumption of the child is also adequate. However, there is a more basic question: are there demonstrated health benefits for children from a diet based on 30% and 10% of calories from total fat and saturated fat, respectively?

Much of the early research on diet/chronic disease links comes from studies on adults. Results from a multicountry study on adult males found that age-adjusted death rate from

coronary artery disease correlated with total dietary fat consumption and this correlation was even stronger for saturated fat consumption (Keys, 1980).

Autopsies performed on young men killed in the Korean or Vietnam Wars revealed grossly visible lesions in the coronary arteries (Strong, 1986).

Strong reviewed the autopsy evidence in which information on risk factors was also available. Elevated serum cholesterol and elevated blood pressure were consistently and positively related to the degree of atherosclerotic lesions, and the level of HDL-cholesterol was inversely related to the lesions.

Only recently has data begun to emerge on risk factors for chronic diseases in children. Serum cholesterol levels in both adults and children in the United States are higher than in a number of other developed countries (Ernst and Obarzanek, 1994). The American diet, high in saturated fat, appears to be a key factor associated with these high serum cholesterol levels. In addition, higher serum cholesterol levels in children are associated with high levels in adults within the same country and, in general, with higher mortality rates from coronary vascular disease (Snetselaar and Lauer, 1992). Results from the Muscatine Study in Iowa indicate that of adults with high LDL-cholesterol levels (greater than the 75th percentile), 59.5% had high levels in childhood (Lauer and Clarke, 1990). Children with high total serum cholesterol levels tend to have a higher probability of high levels as adults.

Data from the Bogalusa Heart Study indicate that children with serum cholesterol in the middle and high range had significantly greater fat intakes than those children in the lowest serum cholesterol category (Berenson et al, 1993). In addition, data indicate that the earliest lesions in the aortas of children appear to be related to levels of LDL-cholesterol and VLDL-cholesterol (Newman et al, 1991). Similarly, data from the Pathobiological Determinants of Atherosclerosis in Youth (PDAY) study have documented a positive correlation between atherosclerotic lesions and LDL-cholesterol in autopsied children (PDAY Research Group, 1990).

Based on the research evidence, a number of public health groups have suggested that lower blood cholesterol levels beginning in childhood could have important preventive effects in the development of atherosclerosis. However, there is some disagreement over the extent to which one should intervene in the diets of children.

The American Academy of Pediatrics (AAP) has noted that the fatty streaks can be found in the aortas of almost all 10-year-old children, quite independent of their diet or their health behaviors (Committee on Nutrition, AAP, 1992); the AAP, which supports the Dietary Guidelines for children 2 years of age and older, cautions against the overzealous limitation of total dietary fat which could limit total energy intake. The American Heart Association recommends an upper limit of 30% of calories from fat for children over the age of 2 as does the National Cholesterol Education Program. Both the American Academy of Pediatrics and the American Heart Association agree that ensuring adequate calories for growth in children is essential.

Research on potential health benefits of following the Dietary Guidelines, until recently, has tended to focus on diet/lipoprotein/atherosclerosis relationships. However, the diet/obesity relationship is now being highlighted as equally important.

Obesity is an independent risk factor for coronary artery disease and is recognized as a precursor to a number of risk factors for chronic diseases (Williams and Kimm, 1993). Research indicates that there are significant positive associations between a high Body Mass Index and cardiovascular disease (Clarke et al, 1986; Webber et al, 1979). Obese individuals are more likely to have elevated systolic and diastolic blood pressure (Ernst and Obarzanek, 1994).

Diet appears to be one key component in the causality of obesity. Recent research examined the relationship between diet and body fatness in 48 children between the ages of 9 and 11 (Gazzaniga and Bruns, 1993). Dietary intake was assessed with three consecutive 24-hour recalls. Results suggest that obese children consumed a significantly greater proportion

of their calories in the form of dietary fat and saturated fat than did the nonobese children. This effect was independent of total energy intake or level of physical activity. These observations are associative, however, and therefore it is not possible to conclude that the higher-fat diet contributed to the obesity.

More of this type of research is needed in order to determine the contribution of individual dietary components to childhood obesity.

Is Obesity Increasing in Children?

Obesity has become a significant public health problem for both adults and children in the U.S.[3] The National Health and Nutrition Examination Survey has collected data since the early 1970s and results indicate that obesity has been increasing in all age/gender groups (Table 11). Long-term studies reinforce these national-level data. Data from the Bogalusa Heart Study indicate that since 1973, 10-year-old children in the same communities have gotten progressively heavier. Children are on average 1.36 kg heavier than in the original cross-sectional study in the early 1970's (Nicklas et al, 1993). Maybe surprisingly, in the Bogalusa study, this increased in overall weight is not accompanied by an increase in height nor is their an increase in energy intake. The authors conclude that a major contributor to the increasing overweight in these communities is decreased physical activity.

Roberts (1993) conducted a prospective study on infants and found that total energy expenditure of infants who were becoming overweight was 20.7% lower on average than infants whose weight was normal. Griffiths and Payne (1976) found that children of obese

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[3]Appendix Three has a discussion of the methodological issues related to measuring obesity. These data would suggest that obesity and energy intake may not be directly linked. Energy expenditure may be as important, or in some cases more important, than caloric consumption in understanding the increasing prevalence of obesity in the United States.

parents had a lower total energy expenditure than that of children of normal weight parents but that children of obese parents also had a lower caloric intake. These observations reinforce the Bogalusa data and indicate that the energy intake of overweight or obese children is not necessarily significantly higher than that of normal weight children.

Other researchers have reported the same or lower calorie consumption when comparing overweight and normal weight children (Eck et al, 1992; Rose and Mayer, 1968).

Dietz and Gortmaker (1985) found a positive and significant association between the amount of TV watching and childhood obesity. The obesity/TV watching association has not, however, been confirmed by all studies (Robinson et al, 1993).

The prevalence of obesity does not seem to be strongly influenced by income level. Surveillance data from 44 states indicate that the prevalence of overweight in children did not show any difference across five income groups (Yip et al, 1993). Children in the highest income category were as likely to be overweight as children in the lowest income grouping. A recent, extensive review of the literature provided an inconsistent picture of the relationship between obesity and socio-economic status in developed societies (Sobal and Stunkard, 1989).

Dietary patterns rather than simple energy or nutrient intake may be more closely linked to obesity. For example, Kumanyika (1993) reports that breastfeeding, duration and the delayed introduction of solid foods are inversely related to childhood obesity. These behavioral patterns may, however, be proxies for other factors such as maternal education, income or time devoted to child care.

Data have already been reviewed (Gazzaniga and Bruns, 1993) that suggest that the percentage of total fat, independent of total caloric intake and activity level, may contribute to overweight in children. Whether a diet lower in total fat and saturated fat contributes to preventing obesity in children remains to be demonstrated.

Clearly the concern about childhood obesity revolves around three issues. First, the obesity/chronic disease links; second, the child obesity/adult obesity links; and third, the well-documented links between obesity and psychological discrimination.

A fairly consistent literature suggests that reduction in overweight alone could reduce the risk for a number of chronic diseases. Research of Lew and Garfinkel (1979) has indicated that of the risk factors for heart disease and cancer, obesity is most closely correlated with increased risk. A reduction in rates of obesity could reduce levels of chronic disease.

Long-term studies show that morbidity and mortality rates from all causes are higher in overweight people and the risk increases with increasing overweight. For example, children initially 5- to 18-years-of-age were followed up 40 to 52 years later and findings indicate that mortality in the sample was linked to relative weight (Neito et al, 1992). Worth noting are the authors' findings that the strongest associations with chronic disease and death were found with adolescent obesity and not adult obesity. These data provide strong support for prevention of obesity early in life.

The negative effects of excess weight in childhood are not limited to long-term outcomes. Studies conducted over the past two decades have documented that obese children are more likely to have elevated serum lipids and blood pressure (Wattigney et al, 1991). Thus short term health is also affected by obesity. In addition, the damaging social consequences of childhood obesity documented several decades ago have now been extended to encompass both social and economic consequences in young adulthood, especially for women (Gortmaker et al, 1993). The long-term consequences of these findings are not fully understood.

Obese children are more likely than normal-weight children to become obese adults (Williams and Kimm, 1993). The risk of a obese child remaining obese as an adult increases with the age of the child. Thus, the predictive for adult obesity is excellent for 18- year-olds who are obese, good for obese 13-year-olds but only moderate at ages younger than 13 (Guo

et al, 1994). Only a small proportion of obese adults were obese as children. However, childhood obesity, particularly during the second decade of life, is a strong predictor of risk of adult obesity. The data would strongly suggest that the earlier one can prevent childhood obesity the higher the likelihood that adult obesity will not occur.

Despite the attention focused recently on childhood obesity, a different type of nutritional problem affects older children in the United States. Eating disorders - anorexia nervosa and bulimia - have become more common. Early diagnosis and treatment are critical for successful intervention. In particular, interventions based on solid science need to be developed to effectively deal with eating disorders.

What are the Major Diet Related Problems Currently for U.S. Children?

The major nutrition problems in the U.S. have changed since World War II. Childhood obesity is now more common, on average, than growth retardation. This is true across all income strata. Physical inactivity combined with poor dietary patterns have contributed to the increasing obesity.

Intake of total fat, saturated fat and sodium for the majority of U.S. children exceeds the levels suggested in the Dietary Guidelines. Efforts to change dietary patterns should focus on the total diet rather than individual components such as fat or sodium. Snacking behaviors are a key area of concern; an increasing proportion of calories and nutrients in the child's diet is coming from snacks. Snacks low in salt and fat should be integrated into the overall diet. The major source of sodium in children's diet is processed foods. It is unlikely that major reductions in sodium content of children's diets will occur without the active involvement of industry in lowering the sodium content of foods.

Of the five major food groups, children are most likely to have low consumption in the vegetable and fruit groups. Increased consumption of vegetables and fruits as snacks for children would be one key way to enhance dietary patterns.

Calcium intake in school-aged children is falling due to decreased consumption of dairy products. A number of the studies reviewed in this paper suggest that it is not possible for children to obtain an adequate amount of calcium without a source of milk in the diet. Consumption of low-fat or skim milk provides the opportunity for children to lower fat intakes yet meet their calcium requirement.

Implication for Public Policy

In the early part of the 20th Century the major nutrition problems for children in the United States centered on underconsumption and dietary deficiency. However, as the data in the tables have shown, nutrient intakes, on average, have steadily improved. With this improvement in dietary intake, problems of stunting (low height for age) and low weight for age have decreased dramatically. A recent mid-term review by the Assistant Secretary for Health (Public Health Service, 1994) indicated that the U.S. has already achieved the Health Objectives 2000 goals for lowering stunting in preschool age children.

However since World War II, chronic diseases such as coronary vascular disease, diabetes, some forms of cancer, and obesity have increased. It is now recognized that many of these chronic disease are, in part, linked to consumption patterns. Problems related to overconsumption are now, on average, more of a problem for the U.S. population than problems of underconsumption.

A recent report (McGinnes and Foege, 1993) suggested that major gains in public health would be made if consumption patterns, including dietary patterns, of children in the U.S. were more in line with Dietary Guidelines.

Several steps need to be taken. First, the data in this paper suggest that in order to have a dramatic impact on childhood obesity a dual strategy of a healthful diet and increased physical activity needs to be developed. Diet by itself is unlikely to bring about the desired result. In addition, energy intakes are already so low for some obese children that further

restrictions might jeopardize their nutrient intakes. Increasing physical activity not only provides the potential for attacking some of the root causes of childhood obesity but it provides a positive message "be more active" rather than the negative message," eat less food".

Nutrition promotion activities that emphasize positive dietary patterns for children that meet the Dietary Guidelines need to be developed. Clearly most children's current diets fall far short of optimal. As already discussed, only a small proportion of American children consume the recommended number of servings of fruits and vegetables. Yet research has shown that fat in the diet is more likely to be displaced when fruits and vegetables are added (Murphy et al, 1992).

Teenage boys have particularly high levels of fat, saturated fat, cholesterol and sodium in their diets (USDA, 1989-91); more than 90% of teenage boys in the 1989 CSFII exceeded the Dietary Guidelines. Dietary patterns that are consistent with lifestyle constraints need to be actively promoted.

The Kellogg Children's Nutrition Survey (Harris/Scholastic Research, 1989) reports that only 1 in 3 third graders to high school seniors self-reported eating the right kinds of foods. Snacks with low nutritional value was one key reason. Only 26% of the children rated their diets as excellent.

Interestingly, the children who attached a high level of importance to good nutrition were more than twice as likely to report that they ate the right foods as those children who rated nutrition as less important. Dietary patterns seemed to get worse as children got older. This would suggest that intervention in the early school years with a curriculum stressing health promotion, physical activity and good nutrition, has this potential for a high payoff.

Changing demographics, including the rising number of single-parent households, has affected children in a number of ways including children's dietary patterns. Children across

all income strata are spending a greater part of their day away from home. Therefore strategies for nutrition promotion need to move beyond the family/child dyad and involve a greater number of players - schools, child care facilities, the community, the private sector.

The Federal Government also has a role to play. First, the Government needs to ensure that all food assistance and nutrition programs incorporate the Dietary Guidelines into program operation. The Dietary Guidelines should build on the foundation of the Recommended Dietary Allowances for calories and other nutrients in each of the programs. Direct service delivery, however, is only part of the answer. An aggressive nutrition promotion program needs to be built into food assistance and nutrition programs in order to increase the likelihood of sustained effectiveness. Newer paradigms of education including the use of social marketing need to be woven into the development of nutrition promotion programs.

School-based interventions offer three major advantages for children. First, more than 95% of children in the U.S. are enrolled in school. Second, since children eat one or two meals a day at school, the cafeteria and classroom can serve as a learning laboratory for promoting sound dietary habits. This is true for children who bring food from home as well as children who purchase foods at school. Third, elementary schools can offer regular physical activity.

The environment in which America's children live has changed dramatically over the past 20 years. As a result, the influences on a child's health and nutritional status are now more complex. Public and private initiatives aimed at improving the nutritional status of children need to respond to this complexity. New directions in nutrition policies are needed to respond to the changing nutritional needs of America's children.

Appendix One: USDA/HHS 1990 Dietary Guidelines for Americans

- Eat a variety of foods
- Maintain healthy weight
- Choose a diet low in fat, saturated fat and cholesterol
- Choose a diet with plenty of vegetables, fruits and grains
- Use sugars only in moderation
- Use salt and sodium in moderation
- If you drink alcoholic beverages, do so only in moderation

Appendix Two: Limitations of the Observations

Documentation of changes in nutrient intakes over time is hampered by a number of factors. First, survey methodologies in studies conducted during the same time period have not always been comparable, and methods used in periodic studies have changed over time. Most recently, in NHANES (1988-1991) for example, automated data collection has standardized and improved the quality of the data. While these data may provide better estimates of actual intake, the validity of comparisons with information obtained in earlier NHANES studies in unknown.

Second, in surveys conducted before NHANES (1982-84) and the CSFII 1985-86, NCHS and USDA used different nutrient data bases. Differences in findings may, to at least some extent, reflect differences in the data bases rather than true changes over time. A recent study (Guenther, Perloff, & Vizioli, 1994) confirmed the need to reanalyze the dietary data from the 1977-78 NFCS to improve the accuracy of estimated intakes of magnesium, iron and vitamins B-6 and B-12. Other methodologic differences add to the problem. In earlier studies of the diets of Hispanic populations, nutrient data bases contained information from commercially prepared foods, which often do not reflect the actual nutrient profiles when the same dishes are prepared in traditional ways in the home. Thus, improvements in data collection and analysis method, while increasing accuracy, may also exaggerate true differences over time. Finally, for some nutrients that may be of public health concern for children and adolescents, the nutrient analysis data are not complete. These include zinc, copper, vitamin B-6 and folate.

The Recommended Dietary Allowances (National Research Council, 1989) generally serve as the standard against which nutrient intakes across age groups and by gender are evaluated. While they remain the best standard available, they too have serious limitations. RDAs for most nutrients have not been obtained from direct studies on children. Instead, they are extrapolated from data on older populations, as well as from animal and laboratory

studies. Their applicability to children and adolescents remains to be demonstrated. Moreover, the somewhat different age groupings used in reporting intakes of key nutrients in many studies further limit direct comparisons with the RDAs.

Appendix Three: Methodological Issues In Measurement Of Obesity

The question of whether and to what extent the prevalence of obesity is increasing is the subject of some debate. Prevalence in a given population depends on the reference data used for comparison, the cutoff levels, and the indicator. There is no generally accepted definition of obesity in children, consistent across age groups, accurately reflecting overall adiposity, and relating to an index of morbidity. Age and sex-specific 85th percentile of BMI or the triceps skinfolds commonly used to define obesity may overestimate the extent of the problem in some groups. The 85th percentile of BMI and triceps skinfold does not define the same level of adiposity at each age. Young children at this point on a reference standard are unlikely to be obese (Obarzanek, 1993).

BMI, an inferred measure of obesity, has commonly been used to assess relative weight. While it does not measure adiposity exclusively and does not assess fat distribution, heights and weights are routinely collected in most surveys with a reasonable level of accuracy. Since these data have been collected for decades, they can be used to measure changes in relative weight. Unfortunately, because it reflects leg length, frame size, and the amount of lean tissue as well as fat, fatness can change at a constant body mass index. Thus it is possible that children could get fatter, as a result of decreased activity, while weight remains unchanged.

Skinfold measurements are subject to measurement error within surveys. Triceps skinfolds, in particular, are affected by sex, race, and individual differences in subcutaneous fat distribution, by the proportion of subcutaneous to internal fat, by the compressibility of the fat layer, and by the individual's state of hydration (Flegal, Harlan, and Landis, 1989). At high levels of fatness skinfold measurements are unreliable (Dietz, 1981).

Finally, the method used to measure relative weight exerts a powerful effect on prevalence estimates. Using a prediction equation to estimate percent body fat from triceps and subscapular skinfolds, researchers estimated rates of obesity of 11.5% for 6- to 11-year-old and 14% for 12- to 17-year-old children in NHANES II, compared to 27% and 22% when estimated by triceps skinfold measures alone (Obazarnek, 1993; Gortmaker et al, 1987).

Given the potential for different findings, depending on the method of measurement, it is of interest that Wolfe et al (1994) recently reported an increased prevalence of obesity compared to NHANES I and NHANES II among school children in New York State, using three different measures, BMI, triceps skinfold, and arm fat area, a measure derived from triceps skinfold and mid-upper-arm circumference.

Table 1 Healthy People 2000: Nutrition Objectives for Children and Adolescents*

Objective 2.3
Maintain prevalence of obesity among adolescents age 12 to 19 at no more than 15%, as estimated in the 1976-1980 NHANES II.

Objective 2.4
Reduce growth retardation among low-income children aged 5 years and younger to less than 10%. In 1988, baseline estimates, depending on race and ethnicity ranged from 13% to 16%.

Objective 2.5
Reduce dietary fat intake to an average of 30% of energy or less and average saturated fat intake to less than 10% of energy among people aged 2 years and older. (No baseline is provided for children and adolescents).

Objective 2.7
Increase to at least 50% the proportion of overweight people aged 12 years and older who have adopted sound dietary practices to attain an appropriate body weight. (No baseline is provided for adolescents).

Objective 2.8
Increase calcium intake so at least 50% of youth aged 12 through 24 years .... consume three or more servings daily of foods rich in calcium. (No baseline is provided for children and adolescents).

Objective 2.10
Reduce iron deficiency to less than 3% among children aged 1 through 4 years. Using the 1976-1980 NHANES II as the baseline, prevalence of iron deficiency in low-income children ranged from 10% to 21%. Using 1983-85 estimates, prevalence in Alaskan native children was 22% to 28%.

Objective 2.17
Increase to at least 90% the proportion of school lunch and breakfast services with menus consistent with nutrition principles in the Dietary Guidelines for Americans.

Objective 2.19
Increase to at least 75% the proportion of the nation's schools that provide nutrition education from preschool through grade 12, preferably as part of quality school health education.

*Adapted from Healthy People 2000: Year 2000 National Nutrition Objectives.

Table 2A Energy Intake (kilocalories) of Children in the United States Based on National Health and Nutrition Examination Surveys 1971/74 to 1988/91

Size/Gender	NHANES I 1971/74	NHANES II 1976/80	NHANES III 1988/91
1-2 Male and Female	1350	1287	1289
3-5 Male and Female	1676	1569	1591
6-11 Male	2045	1960	2036
6-11 Female	2045	1960	1753
12-15 Male	2625	2490	2578
12-15 Female	1910	1821	1838
16-19 Male	3010	3048	3097
16-19 Female	1735	1687	1958

Sources: CDC/NCHS, NHANES I, II, III

Table 2B Energy Intake (kilocalories) of Children in the United States Based on the USDA Continuing Survey of Food Intake by Individuals

Food Energy 1986[1]		Food Energy 1989-1991[2]	
All Children	1,426	Children Ages 5 and under	1,298
Children Ages 1 - 3	1,351	1994	1,195
Children Ages 4 - 5	1,521	Chidren Ages 3 - 5	1,466

1. Based on intakes over 4 non-consecutive days
2. Based on intakes for 1 day

Source: USDA, CSFII

Table 3 Energy Intake of 10 Year Old Children, Bogalusa Cross-Sectional Study 1973/74 to 1987/88

SURVEY YEARS

Dietary Component	1 1973/74	4 1976/77	6 1978/79	9 1981/82	12 1984/85	15 1987/88
Energy (K cal)	2141	2316	2145	2054	2145	2224
N	185	158	224	304	284	284
K cal/Kg Body Wt.	65.5	67.1	62.3	57.4	60.2	60 7
% Energy from Fat	38.4	38.3	38.5	37.4	36.3	35.6
Ponderal Index Kg/M	12.3	12.7	12.6	12.9	13.0	13.4

Source: Nicklas et al, 1993

Table 4 Average Three Day Dietary Intakes of Children by Gender and Age in 1989

Gender and Age	Boys 0-5	Girls 0-5	Boys 6-11	Girls 6-11	Boys 12-18	Girls 12-18
Unweighted Sample Size	243	217	220	215	193	204
Mean Percent of RDA						
Food Energy	92.3	81.6	86.6	81.9	84.1	73.1
Protein	273.1	247.2	226.4	215.4	167.4	140.5
Iron	104.3	100.9	115.9	109.4	136.5	72.2
Calcium	103.7	91.4	106.8	103.0	87.1	64.6
Vitamin A-I.U.	192.0	174.9	138.2	134.1	113.6	113.4
Vitamin C	237.9	185.9	210.7	165.2	184.6	150.6
Vitamin B-6	115.1	110.3	109.9	99.3	108.0	96.0
Niacin	134.9	133.9	132.2	123.3	128.6	114.1
Mean % Cal. from Total Fat	33.4	31.5	34.1	35.2	35.9	35.4
Mean % Cal. from Saturated Fat	14.4	12.7	13.0	13.2	13.5	13.2
Mean Cholesterol (mg)	185.3	169.9	239.0	219.4	321.5	204.7
Mean Sodium	1948.3	1731.0	2801.6	2614.2	3853.5	2831.7
Percentage Meeting Targets:(1)						
Food Energy	37.4%	20.6%	26.6%	15.5%	21.7%	12.5%
Protein	94.8%	91.9%	99.7%	100.0%	98.6%	96.2%
Iron	59.6%	85.8%	84.4%	89.9%	88.7%	39.3%
Calcium	73.3	61.2	76.3	70.1	66.1	30.6
Vitamin A-I.U.	90.0	86.7	73.5	75.7	53.5	55.4
Vitamin C	91.2%	79.6%	89.1%	88.7%	80.4%	67.8%
Vitamin B-6	85.4%	78.5%	89.4%	74.1%	69.2%	68.2%
Niacin	90.8%	87.2%	96.7%	97.9%	84.8%	84.7%
Percentage Exceeding Guidelines:(2)						
Total Fat	81.0%	72.3%	80.5%	91.1%	93.4%	85.4%
Cholesterol	13.1%	13.5%	21.0%	16.7%	44.2%	17.9%
Saturated Fat	91.5%	79.7%	88.2%	96.8%	94.4%	90.8%
Sodium	31.1%	22.1%	66.5%	60.9%	92.6%	66.3%

(1) Targets are 100% for food energy and 75% of RDA for other nutrients.

(2) Guidelines are 30% calories from fat, 10% calories from saturated fat, 300 mg cholesterol, 2,400 mg sodium.

Source: Based on USDA's Continuing Survey of Food Intake by Individuals, 1989.

Table 5A Food Sources of Calories by Fat Intake Group*

Food Group	Fat Intake Group, kcal(%)			
	1 <30%	2 30% - 35%	3 35% - 40%	4 >40%
Breads/Grains	458 (24.5)	415 (22.0)	420 (20.0)	376 (16.1)
Dairy	257 (13.8)	289 (15.3)	331 (16.0)	353 (15.0)
Beverages	208 (11.3)	168 (9.2)	159 (7.6)	144 (6.0)
Candy	200 (11.2)	149 (7.8)	158 (7.3)	153 (6.7)
Vegetables/Soups	170 (8.9)	160 (8.9)	186 (8.9)	221 (8.9)
Desserts	169 (9.4)	196 (10.2)	242 (10.8)	247 (9.6)
Meats**	129 (7.3)	194 (10.4)	301 (13.7)	530 (20.9)
Fruit/Fruit juices	89 (5.1)	82 (4.2)	70 (3.3)	58 (2.3)
Fats and Oils	53 (2.7)	65 (3.5)	84 (3.9)	141 (5.3)

* Fat intake groups were stratified according to percentage of total calories from a fat. The total percentage of total calories by food group does not equal 100% because of rounding. Not all 21 food groups are represented.

** Meats = mixed meats + pork + veal + lamb + beef.

Source: Nicklas et al, 1992

Table 5B Food Sources of Total Fat by Intake Group*

Food Group	Fat Intake Group, kcal(%)			
	1 <30%	2 30% - 35%	3 35% - 40%	4 >40%
Dairy	12.6 (23.4)	14.2 (21.0)	16.7 (19.7)	18.4 (16.0)
Meats**	8.1 (15.8)	12.4 (18.3)	20.5 (22.9)	40.5 (30.7)
Breads/Grains	7.1 (13.2)	7.4 (11.2)	7.7 (9.2)	7.7 (6.7)
Desserts	6.4 (12.4)	8.0 (11.8)	10.8 (11.7)	12.0 (9.4)
Vegetables/Soups	5.9 (10.7)	5.4 (8.6)	7.6 (9.0)	11.5 (9.6)
Fats and Oils	4.7 (8.5)	6.2 (9.0)	7.9 (9.3)	13.5 (9.9)
Snacks	3.0 (5.7)	3.8 (5.7)	3.9 (4.8)	4.9 (4.7)
Poultry	2.3 (4.3)	4.1 (5.6)	3.6 (4.1)	3.4 (3.4)
Candy	1.9 (3.6)	2.9 (4.2)	3.8 (4.3)	4.9 (4.4)
Eggs	0.7 (1.0)	1.7 (2.2)	2.9 (3.0)	3.8 (3.4)

* Fat intake groups were stratified according to percentage of total calories from fat. The total percentage of total fat intake by food group does not equal 100% because of rounding. Not all 21 food groups are represented.

** Meats = mixed meat + pork + veal + lamb + beef.

All comparisons indicated are statistically significant, $P<.05$.

Source: Nicklas et al, 1992

Table 6 Nutrient Intake by Income Level

Income Level Age/Gender	Kilocalories	Percent Fat	Percent Saturated Fat
130% Poverty or Less			
Ages 5 and under (Male and Female	1142	37.2	15.3
6-11 Male	1893	34.6	13.4
6-11 Female	1702	33.8	12.8
12-19 Male	2285	36.7	13.2
12-19 Female	1743	36.4	13.5
131% to 300% of Poverty			
Ages 5 and under (Male and Female)	1270	34.2	14.2
6-11 Male	1799	36.2	13.9
6-11 Female	1678	36.8	14.0
12-19 Male	2380	35.6	13.6
12-19 Female	1773	35.3	13.3

Age/Gender	Calories	Percentage from Fat	Percentage from Saturated Fat
300% of Poverty			
Ages 5 and under (Male and Female)	1274	35.0	14.4
6-11 Male	1997	36.8	14.4
6-11 Female	1663	34.2	13.1
12-19 Male	2435	37.8	14.1
12-19 Female	1707	36.8	14.2

Source: 1987-88 Nationwide Food Consumption Survey, 1-Day Intake (USDA, 1993).

Table 7 Average 3-Day Dietary Intakes of Children by Racial/Ethnic Group in 1989

Race/Ethnicity(3)	White Non-Hispanic	Black Non-Hispanic	Hispanic
Unweighted Sample Size	849	221	177
Mean % of RDA or AEA Consumed			
Food Energy	84.4	79.7	80.9
Protein	214.6	182.5	217.0
Iron	106.0	114.1	97.5
Calcium	98.1	75.6	90.2
Vitamin A-I.U.	150.1	117.0	133.3
Vitamin C	180.4	196.2	218.6
Vitamin B-6	106.6	105.0	107.0
Niacin	127.9	135.4	118.4
Mean % Cal. from Total Fat	34.3	35.2	34.8
Mean % Cal. from Saturated Fat	13.3	13.8	13.6
Mean Cholesterol (mg)	218.8	241.4	231.4
Mean Sodium (mg)	2678.2	2634.0	2492.0
Percentage Meeting Targets: (1)			
Food Energy	22.8%	16.9%	30.0%
Protein	97.1%	97.2%	97.9%
Iron	76.4%	67.0%	65.2%
Calcium	66.3	45.5	56.0
Vitamin A-I.U.	75.1	58.3	64.5
Vitamin C	82.5%	84.5%	80.0%
Vitamin B-6	77.6%	76.7%	80.0%
Niacin	90.5%	93.5%	87.1%
Percentage Exceeding Dietary Guidelines for Americans:(2)			
Total Fat	86.5%	84.5%	79.0%
Saturated Fat	90.8%	89.2%	94.5%
Cholesterol	19.6%	22.9%	25.8%
Sodium	57.6%	54.9%	61.5%

(1) Targets are 100% for food energy and 75% of RDA for other nutrients.
(2) Dietary Guidelines are 30% calories from fat, 10% calories from saturated fat, 300 mg cholesterol, 2,400 mg sodium.
(3) Excludes 45 unweighted children of other racial/ethnic background.
Source: Based on USDA's Continuing Survey of Food Intake by Individuals, 1989.

Table 8 Average 3-Day Dietary Intakes of Children by Food Sufficiency Status in 1989

Household Food Sufficiency Status	Enough of the kinds of food we want to eat	Enough but not always what we want to eat	Sometimes or often not enough to eat (combined)
Unweighted Sample Size Population	739 43,557	488 19,273	64 3,512
Mean % of RDA			
Food Energy	84.4	81.9	74.6
Protein	212.2	205.2	213.4
Iron	108.3	102.3	102.0
Calcium	94.8	90.1	93.9
Vitamin A-I.U.	143.8	145.7	134.8
Vitamin C	195.1	179.8	160.3
Vitamin B-6	107.8	103.5	103.5
Niacin	129.1	125.4	121.8
Mean % Calories from Total Fat	**33.8**	**35.3**	**35.2**
Mean % Calories from Saturated Fat	**13.0**	**14.1**	**13.6**
Mean Cholesterol (mg)	**223.9**	**224.8**	**221.1**
Mean Sodium (mg)	**2702.3**	**2604.1**	**2183.8**
Percentage Meeting Targets:(1)			
Food Energy	24.0	20.7	18.2
Protein	96.6	97.6	97.0
Iron	74.9	67.4	73.0
Calcium	63.3	57.5	66.1
Vitamin A-I.U.	72.8	69.0	71.4
Vitamin C	83.6	82.7	70.9
Vitamin B-6	75.4	84.2	66.1
Niacin	89.4	91.9	93.8
Percentage Exceeding Dietary Guidelines for Americans:(2)			
Total Fat	85.0	83.3	76.2
Saturated Fat	89.9	92.9	80.8
Cholesterol	21.8	19.7	20.8
Sodium	61.2	53.1	31.5

(1) Targets are 100% for food energy and 75% of RDA for other nutrients.
(2) Dietary Guidelines are 30% calories from fat, 10% calories from saturated fat, 300 mg cholesterol, 2,400 mg sodium.
a/ significantly different at p<.05
b/ significantly different at P<.05
Source: Based on USDA's Continuing Survey of Food by Individuals, 1989

Table 9 Total Energy Intake of 871 Children 10-Years of Age

	Fat Intake Group			
	1	2	3	4
	<30%	30%-35%	35%-40%	>40%
White Boys	1954 (56.2)	2036 (58.3)	2371 (67.9)	2665 (76.2)
White Girls	1691 (49.8)	1673 (50.4)	1979 (58.5)	2122 (63.7)
Black Boys	1898 (57.6)	2035 (56.2)	2103 (60.0)	2670 (76.6)
Black Girls	1751 (52.5)	1906 (56.2)	2026 (57.2)	2213 (60.4)
TOTALS	1827 (53.8)	1881 (54.7)	2128 (61.5)	2423 (69.9)

Values represent total calories (calories per kilogram of body weight). Fat intake groups were stratified according to percentage of total calories from fat.

Source: Nicklas et al, 1992

Table 10 Distributions of Mean (SD) Baseline Height, Weight, and Body Mass Index and Mean (SD) Change in Height, Weight, and Body Mass Index Within Quintiles of Dietary Intake of Fat Expressed as Nutrient Density in 215 Children.

	Quintile of Total Fat Density				
	I	II	III	IV	V
	(Low)			(High)	
Height	108.4 (4.4)	109.2 (4.3)	108.1 (4.7)	108.3 (4.1)	108.2 (4.9)
Weight	19.6 (3.4)	20.2 (3.1)	19.3 (3.1)	20.3 (4.2)	19.7 (3.5)
Body Mass Index	16.6 (1.7)	16.8 (1.7)	16.5 (1.8)	17.2 (2.7)	16.7 (1.9)
Change in height, cm/y	6.5 (10.9)	6.9 (1.2)	6.6 (1.3)	6.6 (0.9)	6.3 (1.4)
Change in weight, kg/y	2.8 (1.2)	2.6 (1.3)	2.7 (1.4)	3.1 (1.2)	2.8 (1.5)
Change in body mass index, kg/m per year	0.22 (0.66)	-0.05 (0.78)	0.15 (0.70)	0.34 (0.55)	0.24 (0.75)

No significant relationships between fat intake and stature were found at the .05 level using analysis of variance.

Assessed by 24-hour recall.

Source: Shea et al, 1993

Table 11 Prevalence of overweight among adolescents -- United States, National Health and Nutrition Examination Survey, 1976-1985 (NHANES II) and 1986-1991 (NHANES III)

		Prevalence
Sex/Survey	Sample size	Percentage
Male		
NHANES II	1351	0.15
NHANES III	717	0.2
Female		
NHANES II	1241	0.15
NHANES III	739	0.22
Total		
NHANES II	2592	0.15
NHANES III	1456	0.21

Source: CDC/NCHS

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